# Back Injury

From HumanResearchWiki

## Contents



## Introduction

A back injury usually involves a strain or sprain in the supporting muscles of the vertebral spine, especially common in the lumbar region, and usually involves pain and functional impairment. The most common mechanism of injury terrestrially is lifting.[1] The dynamics of this injury is different in microgravity but may occur when a crewmember is translating a high mass object or during regular exercise. A pre-existing history of a significant back injury increases the risk of occurrence on orbit. Treatment is tailored to the specific condition and often includes the alleviation of pain with analgesics.[2]

## Clinical Priority and Clinical Priority Rationale by Design Reference Mission

*One of the inherent properties of space flight is a limitation in available mass, power, and volume within the space craft. These limitations mandate prioritization of what medical equipment and consumables are manifested for the flight, and which medical conditions would be addressed. Therefore, clinical priorities have been assigned to describe which medical conditions will be allocated resources for diagnosis and treatment. "Shall" conditions are those for which diagnostic and treatment capability must be provided, due to a high likelihood of their occurrence and severe consequence if the condition were to occur and no treatment was available. "Should" conditions are those for which diagnostic and treatment capability should be provided if mass/power/volume limitations allow. Conditions were designated as "Not Addressed" if no specific diagnostic and/or treatment capability are expected to be manifested, either due to a very low likelihood of occurrence or other limitations (for example, in medical training, hardware, or consumables) that would preclude treatment. Design Reference Missions (DRMs) are proposed future missions designated by a set of assumptions that encompass parameters such as destination, length of mission, number of crewmembers, number of Extravehicular Activities (EVAs), and anticipated level of care. The clinical priorities for all medical conditions on the Exploration Medical Condition List (EMCL) can be found here (https://humanresearchwiki.jsc.nasa.gov/index.php?title=Category:All_DRM). The EMCL document may be accessed here (https://humanresearchwiki.jsc.nasa.gov/images/6/62/EMCL_RevC_2013.pdf).*

| Design Reference Mission | Clinical Priority | Clinical Priority Rationale |
|---|---|---|
| Lunar sortie mission<br><br>Assumptions:<br>▪ 4 crewmembers (3 males, 1 female)<br>▪ 14 days total<br>▪ 4 EVAs/ crewmember<br>▪ Level of Care 3 | Shall | Back injury can encompass a wide range of possible scenarios from muscle strain to spinal cord injury. Most cases occurring on a lunar sortie mission are expected to be minor. However, even the minor injuries usually involve pain and functional impairment. While not all available terrestrial treatment modalities will be feasible during space flight, alleviation of pain with analgesics should be provided. |
| Lunar outpost mission<br><br>Assumptions:<br>▪ 4 crewmembers (3 males, 1 female)<br>▪ 180 days total<br>▪ 90 EVAs/ crewmember<br>▪ Level of Care 4 | Shall | Back injury can encompass a wide range of possible scenarios from muscle strain to spinal cord injury. Most cases occurring on a lunar outpost mission are expected to be minor. However, even the minor injuries usually involve pain and functional impairment. While not all available terrestrial treatment modalities will be feasible during space flight, alleviation of pain with analgesics should be provided. |
| Near-Earth Asteroid (NEA) mission<br><br>Assumptions:<br>▪ 3 crewmembers (2 males, 1 female)<br>▪ 395 days total<br>▪ 30 EVAs/ crewmember<br>▪ Level of Care 5 | Shall | Back injury can encompass a wide range of possible scenarios from muscle strain to spinal cord injury. Most cases occurring on the NEA mission are expected to be minor. However, even the minor injuries usually involve pain and functional impairment. While not all available terrestrial treatment modalities will be feasible during space flight, alleviation of pain with analgesics should be provided. |

# Initial Treatment Steps During Space Flight

*A link is provided to a prior version of the International Space Station (ISS) Medical Checklist, which outlines the initial diagnostic and treatment steps recommended during space flight for various conditions which may be encountered onboard the ISS. Further diagnostic and treatment procedures beyond the initial steps outlined in the Medical Checklist are then recommended by the ground-based Flight Surgeon, depending on the clinical scenario. Please note that this version does not represent current diagnostic or treatment capabilities available on the ISS.*

*While more recent versions of this document are not accessible to the general public, the provided version of the checklist can still provide a general sense of how medical conditions are handled in the space flight environment. Medical Checklists will be developed for exploration missions at a later point in time.*

Please note this file is over 20 megabytes (MB) in size, and may take a few minutes to fully download.

ISS Medical Checklist (http://www.nasa.gov/centers/johnson/pdf/163533main_ISS_Med_CL.pdf)

# Capabilities Needed for Diagnosis

*The following is a hypothetical list of capabilities that would be helpful in diagnosis. It does not necessarily represent the current capabilities available onboard current spacecraft or on the ISS, and may include capabilities that are not yet feasible in the space flight environment.*

- Imaging [such as ultrasound, X-ray, computed tomography (CT), magnetic resonance imaging (MRI)]

# Capabilities Needed for Treatment

*The following is a hypothetical list of capabilities that would be helpful in treatment. It does not necessarily represent the current capabilities available onboard current spacecraft or on the ISS, and may include capabilities that are not yet feasible in the space flight environment.*

- Analgesics (non-narcotic, narcotic, oral or injectable)

# Associated Gap Reports

*The NASA Human Research Program (HRP) identifies gaps in knowledge about the health risks associated with human space travel and the ability to mitigate such risks. The overall objective is to identify gaps critical to human space missions and close them through research and development. The gap reports that are applicable to this medical condition are listed below. A link to all of the HRP gaps can be found here (http://humanresearchroadmap.nasa.gov/Gaps/).*

1.01 - We do not know which emerging technologies are suitable for preflight medical screening for exploration missions.
2.01 - We do not know the quantified health and mission outcomes due to medical events during exploration missions.
2.02 - We do not know how the inclusion of a physician crew medical officer quantitatively impacts clinical outcomes during exploration missions.

3.01 - We do not know the optimal training methods for in-flight medical conditions identified on the Exploration Medical Condition List taking into account the crew medical officer's clinical background. (Closed)
3.03 - We do not know which emerging technologies are suitable for in-flight screening, diagnosis, and treatment during exploration missions.
4.01 - We do not have the capability to provide a guided medical procedure system that integrates with the medical system during exploration missions.
4.02 - We do not have the capability to provide non-invasive medical imaging during exploration missions.
4.03 - Limited capability to treat back/neck pain and injuries in the space flight environment
4.08 - We do not have the capability to optimally treat musculoskeletal injuries during exploration missions.
4.14 - We do not have the capability to track medical inventory in a manner that integrates securely with the medical system during exploration missions.
4.15 - Lack of medication usage tracking system that includes automatic time stamping and crew identification
4.17 - We do not have the capability to package medications to preserve stability and shelf-life during exploration missions.
4.24 - Lack of knowledge regarding the treatment of conditions on the Space Medicine Exploration Medical Condition List in remote, resource poor environments (Closed)
5.01 - We do not have the capability to comprehensively manage medical data during exploration missions.

# Other Pertinent Documents

# List of Acronyms

| | |
|---|---|
| **C** | |
| CT | Computed Tomography |
| | |
| **D** | |
| DRM | Design Reference Mission |
| | |
| **E** | |
| EMCL | Exploration Medical Condition List |
| EVA | Extravehicular Activity |
| | |
| **I** | |
| ISS | International Space Station |
| | |
| **M** | |
| MB | Megabyte |
| MRI | Magnetic Resonance Imaging |
| | |
| **N** | |
| NEA | Near Earth Asteroid |

# References

1. Merck Manual. Musculoskeletal and Connective Tissue Disorders. Porter RS, editor. 2006. Whitehouse Station, N.J, Merck Sharp & Dohme Corp.
2. International Space Station Integrated Medical Group. Medical Checklist ISS - All Expeditions. Houston: National Aeronautics and Space Administration; 2008 (Internal NASA document - Not publicly available).

# Last Update

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